Coll. Antropol. **31** (2007) 1: 109–121
Original scientific paper

Body Mass Index, Prevalence of Overweight and Obesity in Lithuanian Children and Adolescents, 1985–2002

Janina Tutkuviene

Department of Anatomy, Histology and Anthropology, Faculty of Medicine, Vilnius University, Vilnius, Lithuania

A B S T R A C T

The study provides the body mass index (BMI), the prevalence of overweight (OW) and obesity (OB) in Lithuanian children and adolescents, 1985–2002. In the 2000–2002 more than 9,000 schoolchildren of 7–18 years old were investigated in the 5 biggest towns and surrounding settlements of Lithuania. These data were compared with the 1985 data. The prevalence of OW and OB was estimated using the International Obesity Task Force (IOTF) cut-off points. The prevalence of OW in Lithuanian children and adolescents was higher among younger schoolchildren in comparison with older adolescents. OW was lower among the older girls in comparison with the older boys: 4.60%–11.50%/4.80%–13.62% in the 7–13 years girls/boys, versus 1.5%–6.60%/3.90%–9.50% in the 14–18 years old girls/boys. The prevalence of OW among younger Lithuanian adolescents did not change significantly in the last 15 years, but it slightly decreased in older boys and demonstrably diminished in older adolescent girls. In generally, the prevalence of OW among Lithuanian adolescents is low in comparison with the prevalence of OW in children from the other countries.

Key words: *body mass index, overweight, obesity, cut-off points, Lithuanian children*

Introduction

The changes of body size during the growth period reflect maturation, nutritional level of an individual, and general well being. Marginal deviations of body size, body composition and body proportions during the growth process, especially during the critical periods of growth and maturation, are chiefly related to certain pathologies of the organism, and could reflect environmental factors, for example, disturbances in life style and nutrition, social welfare and ecology[1–5]. Benefits of growth monitoring include defining chronic disorders, as well as providing identification of risk for poor health. The latter advantage is of a major significance in the determining general welfare of the certain population.

The monitoring of child growth and maturation is a routine practice in a child health care worldwide. The evaluation of the linear growth is widely described and discussed in a literature: the majority of scientists are in agreement with height screening procedures. However, monitoring weight status, the defining overweight and obesity in children and adolescents is the complex question, which is under permanent review[1–4]. It is assumed, that obesity is the abnormal accumulation of adipose tissue, which could impair individual's health, though measuring the level of adipose tissue and determining, when it is likely to affect health, is not an easy task[2–4]. The methods for the direct estimation of the body fat could be of a greatest value in obesity diagnose, however, they are not often available and commonly used in daily practice due to complexity, expensive, or invasive techniques. Hence, the indirect indicators, mostly weigh and height relation indices, are widely used, and simple anthropometry still remains the main method in the growth monitoring[1–4].

The interpretation of different anthropometric indices undergoes constant review as well: the searching for an appropriate indicator for judgement, the revising of cut-off points for overweight and obesity is the continuous process, which is under discussion[3–12]. Recent investigations of the indices of overweight and obesity in children and adolescents, as well as the findings on correlation between the obesity and general health status, are multiple and discrepant[5–13]. However, despite the increasing critique[9–11] recently, the body mass index BMI, or Quetelet

Received for publication December 20, 2006

Index (the weight in kilograms divided by square of the height in meters), remains the most popular and usable indicator for weight status tracking in children and adolescents[2–4,6,12].

The rising prevalence of overweight and obesity in USA, Europe and even in many Asian countries is an important paediatric health problem, and is reaching the rate of worldwide epidemic[6–8,12,13]. Childhood obesity is linked to serious health complications, for example, child and adolescent cardiovascular risk, diabetes, and adult mortality[5,13–17]. Moreover, the obese child or adolescent is at risk of becoming an obese adult, but this relationship is sex and age dependent, and the magnitude of this association depends on the relative fatness of the child[5,18]. On the other hand, the low birth weight is associated with the obesity in adult ages also[14,17,19]. Hence, when searching for the appropriate criteria to define childhood obesity, the investigations of possible factors and the relationship between weight status and general well being throughout the life of an individual are of great significance.

While describing and interpreting the body size and frame of an individual the following terms and definitions for weight status are commonly used[1–4]. Overweight is assumed as a high weight-for-height (not necessarily high fat accumulation). Obesity should be considered in the context of adiposity measurements (the skin fold thickness, the percent of body fat, etc.), but the majority of the individuals with a high weight-for-height are obese. There are no strict cut-offs for screening overweight and obesity in children and adolescents worldwide. WHO recommends revised CDC (CDC/NCHS, 2000) growth charts[20]: ≥85 percentile of BMI – for overweight, and ≥95 – for defining obesity.

Nevertheless, while screening the overweight and obesity many investigators are using ≥90, 97th percentiles of BMI according to age and sex[21–32], and few authors recommend 98th, 99th and 99.6th percentiles of BMI for precise monitoring of certain grades of obesity[33]. Recently the recommendations of the International Obesity Task Force (IOTF) are taking place, – these international reference values were based on the data from six countries[6]: the sex and age depended cut-off points, which corresponded at the age of 18 years the BMI value of 25.0 were used for defining the overweight, and those, that corresponded the BMI value of 30.0 – for defining the obesity.

The international recommendations are useful for the comparison of the data on overweight and obesity among different populations, because local standards of BMI vary specifically. Usually, the local reference data and cut-off points for growth monitoring are based on the studies of affluent, well-nourished and healthy populations. The local reference data are useful for individual growth monitoring within the population, and helps to identify the risk for health, but growth and development varies widely and depends on genetic as well as the environmental factors (socio-economical, ecological, etc.)[5,7–8,12,13].

Searching for an »ideal« reference standard raises a number of issues. For example, growth data according to ethnic group and parental size, body mass index according to sex, age and body frame, weight status according to sex, age, height and somatotype are under discussion[3–4,8,10–12]. Though the local standards of certain measurements reflect normal variety of the indicator within the population, if there are many individuals who are deviant, for example, a high prevalence of obesity in population, the marginal percentiles of BMI would exceed the same percentiles of the BMI of population with low prevalence of obesity. Hence, the international references and the universal cut-off points allow comparison of the nutritional status of populations from the different parts of the world[4,6].

The aim of the present study was to track the changes of BMI, the prevalence of overweight and obesity in Lithuanian children and adolescents during the 1985–2002, and to compare the indices of weight status of Lithuanian schoolchildren with the same indicators of children from the other countries.

Materials and Methods

In the present study BMI data from several cross-sectional growth investigations carried out in Lithuania in 2000–2002 were analysed. In total more than 9,000 schoolchildren aged 7–18 years old participated from the 5 biggest cities and surrounding settlements of Lithuania: Vilnius (the capital of Lithuania), Kaunas (second largest town), Klaipeda, Siauliai and Panevezys (Table 1). For the statistical analysis two data sets were constructed: the data set of Vilnius schoolchildren (2000), and the data set of the four other towns of Lithuania (2002). Anthropometry was performed according to the standard methods of Martin-Saller[34]. Measurements were made by the author and five researchers trained in anthropo-

TABLE 1
NUMBER OF CHILDREN INVESTIGATED IN LITHUANIA, 1985–2002

Age (years)	Vilnius, 1985		Vilnius, 2000		Other towns of Lithuania, 2002	
	Girls	Boys	Girls	Boys	Girls	Boys
7	86	103	83	79		
8	113	106	80	83		
9	98	99	89	91		
10	103	106	98	87	156	163
11	103	118	92	91	410	375
12	105	107	86	99	461	313
13	120	108	94	88	636	345
14	123	136	89	92	667	356
15	133	113	96	93	559	371
16	107	99	95	91	625	286
17	110	94	102	104	474	233
18	100	115	121	118	268	193
Total	1,301	1,304	1,128	1,116	4,256	2,635

metry techniques, using well tested and calibrated equipment. The recent data on BMI from Vilnius and other towns of Lithuania were compared with the data of Vilnius schoolchildren from the 1985 study. These data were collected by the author.

The data were computed using the standard programs of statistical packages (SPSS, EXCEL). The statistical significances of the differences between the data of Vilnius schoolchildren from the 1985 and the 2000 studies, also between the data from Vilnius (2000) and other Lithuanian towns (2002), as well as the differences between girls and boys data were determined using the Student's *t* test[35].

The prevalence of overweight and obesity in children was estimated using the international cut-off points recommended by International Obesity Task Force (IOTF)[6]: the cut-off points, which at the age of 18 years corresponded the BMI value of 25.0, were used for defining the overweight, and those that corresponded the BMI value of 30.0 served for defining the obesity.

The comparison of the marginal percentiles of BMI of children and adolescents from Lithuania and other countries with the international cut-off points was performed. The reference data on the BMI of schoolchildren of the following countries were used: China[21], Czech[22], Estonia[23], Flanders[24], France[25], Germany[26], Iran[27], Italy[28], The Netherlands[29], Poland[30], Russia[31], Sweden[32], UK[33], US[20].

Results

The body mass index of Lithuanian girls and boys, 2000–2002

The mean, standard deviation, and the main percentiles of BMI of Vilnius schoolchildren are given in the Table 2 and 3; the descriptive statistics of BMI of children from the other four towns are presented in the Tables 4 and 5 (data are not smoothed). Summing up the data of the 2000–2002 studies, the following changes in BMI in Lithuanian children were revealed: the mean of BMI increased from 15.46/16.65 (girls/boys) at the age of 7 years up to 20.26–20.77/20.44–21.7 (girls/boys) at the age of 18 years (Tables 2, 3, 4, 5). The most evident increment of BMI in girls was detected between the 12 and 14 years of age, while in boys it was between the 14 and 16 years of age. It coincided with the time of pubertal growth spurt in modern Lithuanian schoolchildren[36,37].

Though the sexual differences between the mean, the 50th and the 3rd BMI percentiles in boys and girls were minor, the evident inequality in age dynamics of the right marginal percentiles of the BMI was detected between sexes. The differences of the 95th and the 97th BMI percentiles between boys and girls were increasing with the age, and the latter percentiles were considerably higher in boys than in girls at the age of the 17–18 years (Tables 2, 3, 4, 5). Hence, it could be assumed that Lithuanian girls at the end of adolescence had more slender bodies and were less overweight in comparison with the boys of the same age.

The mean averages of unsmoothed BMI values of Vilnius schoolchildren (2000) and the children from the other Lithuanian towns (2002) were very similar and differed statistically significantly for only a few age and sex groups (Table 4 and 5). The comparison of the 3rd, 50th and the 97th percentiles of BMI of Vilnius schoolchildren and BMI of the children from the other four towns of Lithuania (the percentiles smoothed by moving average) showed minor differences with the exception of the 97th percentile, which was evidently lower in the 10–15 year old Vilnius boys and higher in the 10–12 year old Vilnius girls (Figure 1 and 2). It could be related to the big variability of the right marginal BMI percentiles, and likely, with the small number of individuals at the 97th BMI percentile, especially in Vilnius 2000 study (Table 1).

TABLE 2
BODY MASS INDEX OF VILNIUS GIRLS, 1985–2000 (DATA NOT SMOOTHED)

Age (years)	Vilnius, 1985		p 1985/2000	Vilnius, 2000											
	Mean	SD		Mean	SD	3P	5P	10P	25P	50P	75P	85P	90P	95P	97P
7	15.55	1.38	0.6811	15.46	1.73	13.20	13.31	13.65	14.24	15.04	16.31	17.04	17.40	18.42	20.10
8	15.71	1.83	0.0011	15.01	1.85	11.56	12.44	13.53	14.04	14.71	15.72	16.29	16.93	18.18	19.56
9	16.50	1.86	0.0000	15.57	1.96	12.89	13.02	13.60	14.26	15.18	16.36	17.46	18.71	19.52	19.79
10	16.53	1.75	0.4570	16.35	2.51	12.91	13.20	13.62	14.68	16.33	17.68	19.24	19.87	20.72	21.49
11	17.69	2.70	0.0078	16.98	2.63	13.66	13.95	14.13	15.19	16.42	18.26	19.24	21.35	21.67	22.19
12	17.30	2.52	0.1745	17.67	3.39	13.51	14.14	14.34	15.34	17.40	19.34	20.42	21.19	22.98	24.86
13	18.74	2.71	0.8760	18.70	2.61	14.98	15.36	15.60	16.58	18.51	20.37	21.76	21.91	22.58	23.16
14	19.85	2.51	0.0091	19.18	2.67	15.91	16.02	16.19	17.51	18.52	20.75	21.85	22.49	25.01	25.13
15	20.58	2.58	0.0001	19.68	2.29	15.74	15.90	16.74	18.23	19.95	21.06	21.81	22.43	23.02	23.80
16	21.51	2.70	0.0000	20.46	1.99	17.22	17.51	17.96	19.02	20.57	22.01	22.66	22.80	22.89	23.97
17	22.40	3.44	0.0000	19.97	2.23	16.59	16.85	17.05	18.62	19.81	21.07	22.19	22.67	23.66	24.29
18	21.61	2.72	0.0005	20.77	1.93	17.36	17.65	18.30	19.39	20.95	22.29	22.91	23.18	23.93	24.35

P – percentile

As for the 3rd and the 50th percentiles, only minor differences between the Vilnius data (2000) and the rest of Lithuania (2002) were detected (Figure 1 and 2). The 50th percentiles of BMI in Vilnius boys and boys from the other towns were nearly identical, but the 50th percentile was slightly higher in the 13–16 year old Vilnius girls.

TABLE 3
BODY MASS INDEX OF VILNIUS BOYS, 1985–2000 (DATA NOT SMOOTHED)

Age (years)	Vilnius, 1985		p 1985/2000	Vilnius, 2000											
	Mean	SD		Mean	SD	3P	5P	10P	25P	50P	75P	85P	90P	95P	97P
7	15.85	1.54	0.0003	16.65	1.75	14.44	14.47	14.81	15.45	16.35	17.45	18.17	19.16	20.32	20.55
8	16.43	1.78	0.0261	15.94	1.80	13.64	13.82	13.96	14.76	15.48	17.05	17.57	18.00	20.01	20.14
9	16.53	2.09	0.9007	16.50	2.33	13.48	13.61	14.08	15.04	16.35	17.34	18.24	18.92	21.45	21.95
10	16.95	1.82	0.4564	16.80	2.00	14.19	14.46	14.84	15.76	16.48	17.17	18.19	19.76	21.53	21.93
11	17.58	2.36	0.2988	17.33	2.24	13.78	14.03	15.25	16.13	17.00	17.93	18.81	20.11	21.11	22.06
12	18.24	2.63	0.0012	17.48	2.66	14.26	14.31	15.11	15.76	16.88	18.87	19.62	21.17	21.98	22.30
13	18.36	1.96	0.2056	18.07	2.02	15.24	15.54	15.87	16.72	17.90	19.17	20.17	21.04	21.89	22.06
14	18.82	2.15	0.5175	18.66	2.38	15.39	15.90	16.44	17.08	18.35	19.62	20.54	21.58	22.15	23.15
15	19.91	2.47	0.0084	19.30	2.43	16.25	16.37	16.92	17.82	19.03	20.31	21.22	21.71	22.73	23.18
16	21.00	2.13	0.2976	20.72	2.84	16.32	16.83	17.10	19.11	20.52	22.09	23.56	24.66	24.82	26.82
17	21.35	2.51	0.0000	20.21	2.32	16.91	17.22	17.67	18.54	20.00	21.43	22.46	23.38	25.00	25.12
18	22.02	2.95	0.0000	20.44	2.78	16.88	17.25	17.37	18.20	20.16	22.20	22.84	23.23	26.02	27.01

P – percentile

TABLE 4
BODY MASS INDEX OF LITHUANIAN GIRLS, 2000–2002 (DATA NOT SMOOTHED)

Age (years)	Vilnius, 2000		p 2000/2002	Other towns of Lithuania, 2002										
	Mean	SD		Mean	SD	3P	5P	10P	25P	50P	75P	90P	95P	97P
10	16.35	2.51	0.0540	16.82	2.39	13.71	13.92	14.27	15.23	16.4	17.82	20.08	21.09	20.35
11	16.98	2.63	0.1602	16.67	2.41	13.18	13.50	14.02	15.15	16.4	17.86	19.71	21.09	21.09
12	17.67	3.39	0.0474	17.21	2.45	13.38	13.75	14.57	15.56	16.89	18.49	20.13	21.46	22.51
13	18.70	2.61	0.0008	17.97	2.65	14.02	14.47	15.06	16.22	17.63	19.23	21.28	22.76	23.88
14	19.18	2.67	0.1103	18.83	2.52	14.82	15.43	16.02	17.15	18.52	20.13	21.99	23.42	24.32
15	19.68	2.29	0.2362	19.46	2.60	15.08	16.02	16.82	17.78	19.04	20.66	22.55	24.35	25.42
16	20.46	1.99	0.0026	19.89	2.45	16.53	16.76	17.26	18.29	19.49	21.08	22.86	24.44	25.39
17	19.97	2.23	0.2648	20.20	2.37	16.44	16.80	17.44	18.59	19.95	21.61	23.1	24.09	25.60
18	20.77	1.93	0.0084	20.26	2.34	16.73	17.09	17.50	18.59	20.07	21.65	22.98	24.32	25.06

P – percentile

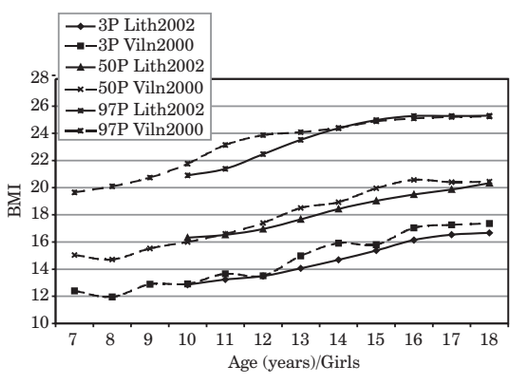

Fig. 1. The 3rd, 50th and 97th BMI percentiles (P) of Vilnius girls and girls from the other towns of Lithuania, 2000–2002.

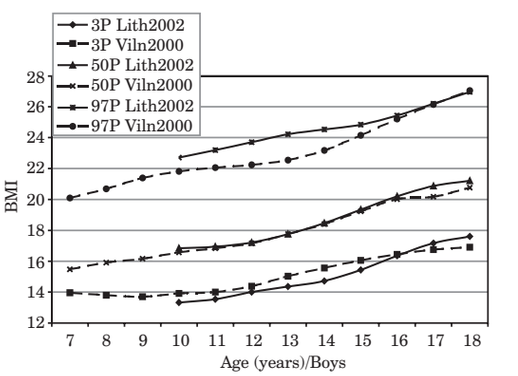

Fig. 2. The 3rd, 50th and 97th BMI percentiles (P) of Vilnius boys and boys from the other towns of Lithuania, 2000–2002.

TABLE 5
BODY MASS INDEX OF LITHUANIAN BOYS, 2000–2002 (DATA NOT SMOOTHED)

Age	Vilnius, 2000		p 2000/ 2002	Other towns of Lithuania, 2002										
	Mean	SD		Mean	SD	3P	5P	10P	25P	50P	75P	90P	95P	97P
10	16.80	2.00	0.0468	17.22	2.75	13.17	13.39	14.7	15.66	16.89	18.37	20.04	22.21	22.86
11	17.33	2.24	0.8101	17.28	2.46	13.45	14.02	14.74	15.6	16.89	18.55	20.49	21.73	22.84
12	17.48	2.66	0.5037	17.61	2.48	14.09	14.64	15.15	16.04	17.09	18.75	20.64	22.07	23.16
13	18.07	2.02	0.1964	18.33	2.81	14.41	14.8	15.58	16.65	17.78	19.79	21.45	23.22	25.41
14	18.66	2.38	0.9881	18.66	2.61	14.52	15.1	15.87	17.10	18.37	19.87	21.82	23.44	24.38
15	19.30	2.43	0.7789	19.35	2.36	15.43	15.75	16.38	17.85	19.37	20.75	22.46	23.38	23.93
16	20.72	2.84	0.0500	20.26	2.67	16.37	16.52	17.51	18.72	20.23	21.52	22.82	24.31	25.69
17	20.21	2.32	0.0001	21.14	2.59	17.24	17.51	17.93	19.59	20.96	22.53	24.14	25.39	26.24
18	20.44	2.78	0.0000	21.70	2.83	17.84	18.27	18.74	20.06	21.33	22.84	24.64	25.59	26.96

P – percentile

The 3rd BMI percentile was also slightly higher in the 13–16 year old Vilnius girls and in the 13–15 year old Vilnius boys. These differences were not statistically significant, and could be related to the random variation of the marginal BMI values due to the moderate number of Vilnius children. One more reason for the lack of statistical significance could be the different maturation tempo and rate of the children from different geographical regions of Lithuania. Our former studies showed that sexual maturation of Vilnius children occurred earlier in comparison with children in the smaller towns[38].

Hence, it could be assumed, that BMI was very similar in the schoolchildren from Vilnius and other towns of Lithuania. This phenomenon partially could be explained by the fact, that Vilnius population is mixed and represents all geographical regions of Lithuania quite well: after the Second World War the migration from the different settlements to the capital of Lithuania started, and this tendency still persists, though at the slower rate. On the other hand, at the present time the socio-economic situation is rather different and is better in the capital of the country in comparison with the other towns of Lithuania, especially with the surrounding settlements[39–41]. Therefore, our findings could be interpreted as showing biological similarity of the Lithuania population. However, more detail studies of the physical status of children from certain towns and settlements and investigations of the socio-economic, life style, and nutritional factors should be conducted with the purpose of revealing the differences in physique of children from diverse geographical regions of Lithuania.

The changes of BMI in Lithuanian girls and boys during the 1985–2002

Our former studies demonstrated, that the growth acceleration of Lithuanian children stabilized during the last 15 years, and the height of Lithuanian schoolchildren in the 1998–2001 did not differ from the 1985 data significantly[37]. In the present study we analysed changes of the mean and the main percentiles of BMI during the last 15 years. In generally, the mean averages of unsmoothed BMI values of Vilnius girls from the 2000 study were noticeable smaller than BMI values of girls from the 1985 study. Especially big statistically signifi-

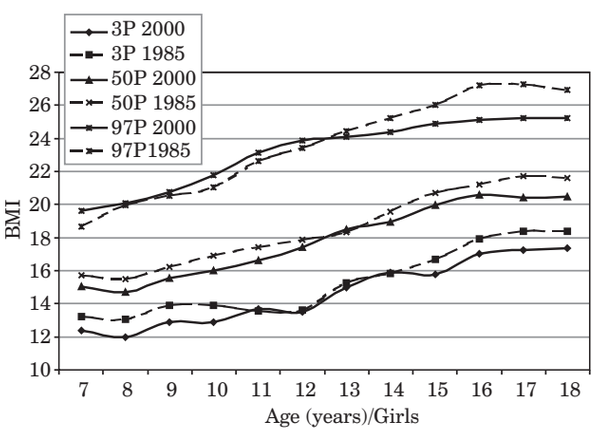

Fig. 3. The 3rd, 50th, 97th BMI percentiles (P) of Vilnius girls, 1985–2000.

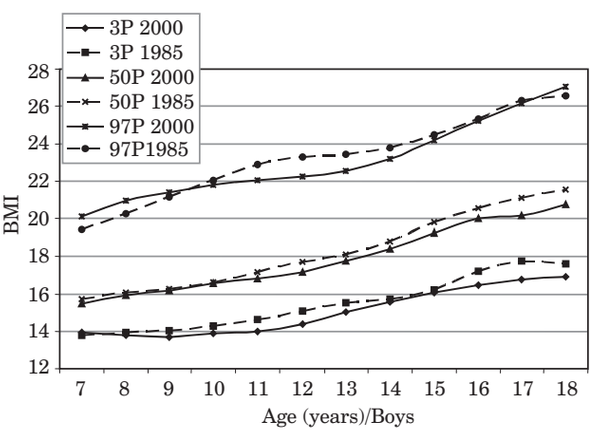

Fig. 4. The 3rd, 50th, 97th BMI percentiles (P) of Vilnius boys, 1985–2000.

cant differences in the BMI occurred at the end of adolescence (Table 2). The mean averages of unsmoothed BMI values of Vilnius boys from the 2000 study were also slightly smaller than BMI values of boys from the 1985 study. These differences were statistically significant only in few age groups (Table 3).

The comparison of the 50th, also the marginal 3rd and the 97th percentiles of BMI of Vilnius schoolchildren from the 2000 study with the similar data from the 1985 study revealed certain sex differences in the changes of BMI during the last decades (data smoothed by moving average, Figure 3 and 4). In generally, the BMI changed more in girls than in boys, and the bodies of girls, especially at the end of adolescence, in the 2000 study were more slender in comparison with the girls from the 1985 study. The small diminishing of the 50th and the 3rd percentile of BMI in boys from the 2000 study was detected at the very end of the adolescent period also. However, there was no statistically significant difference between the 97th percentiles of BMI in boys from the recent and the former studies. Meanwhile, the 97th BMI percentile in girls decreased between the 1985 and the 2000 studies.

Taking into account differences in the BMI data in schoolchildren from Vilnius and the other Lithuanian towns (2002), the same conclusion on the changes of the 97th percentile can be drawn. Speaking about the BMI changes during the 1985–2002, it is important to point out once again, that these changes had happened in the context of the stabilisation of height acceleration process in Lithuanian schoolchildren during the investigated period. Hence, it could be assumed, that during the last decade Lithuanian girls became more slender in comparison with the boys, and these changes were especially evident at the end of adolescence period.

Such a tendency in the BMI of older Lithuanian adolescents suggests, that during the last 15 years girls were under the influence of certain factors, which could be related with changes in life style, modern-day fashion and the demand for optimal female bodies to be unrealistically thin. These factors were discussed in our former studies[42–43].

However, after the political alterations in 1990, very dramatic changes in economic and social conditions happened in the country. The bodies of Lithuanian boys underwent minor slenderizing also, and it may be related to the nutritional factors, changes in physical activity and body composition. Investigations could help to reveal the reasons for the diminishing BMI and could answer, which component of body mass – the lean body mass or body fat – underwent changes.

The prevalence of overweight and obesity in Lithuanian girls and boys, 2000–2002

The analysis of the prevalence of overweight and obesity in Lithuanian children confirms the data on the differences in marginal BMI percentiles in girls and boys. Generally, in the 2000–2002 study the prevalence of overweight varied from 1.5%/2.6% up to 10.5%/9.9% in girls/boys respectively; the prevalence of obesity varied from 0.0%/0.0% up to 2.9%/4.37% (Table 6 and 7). Only the slight, but not statistically significant differences ($p > 0,05$) in prevalence of overweight and obesity were detected between Vilnius schoolchildren and children from the other four towns of Lithuania in the 2000–2002 study, and it was estimated for both sexes (Table 6 and 7).

The analysis of the prevalence of overweight and obesity in the 2000–2002 according to the progress of adolescence showed the following regional differences (Figure 5 and 6). The data of Vilnius boys and boys from the other towns did not differ statistically significant ($p > 0.05$) at the beginning and at the end of adolescence (Figure 6). On the other hand, it was revealed slightly more over-

TABLE 6
PREVALENCE (%) OF OVERWEIGHT (OW) AND OBESITY (OB) IN LITHUANIAN GIRLS, 1985–2002

Age (years)	Overweight (%), BMI ≥25 and <30					Obesity (%), BMI ≥30				
	Vilnius, 1985	p 1985/2000	Vilnius, 2000	p 2000/2002	Other towns, 2002	Vilnius, 1985	p 1985/2000	Vilnius, 2000	p 2000/2002	Other towns, 2002
7	4.65	0.3701	8.50			0.00	0.3141	1.70		
8	1.77	0.3240	4.60			1.77	0.8897	1.50		
9	8.16	0.8960	7.60			1.02	0.3164	0.00		
10	3.88	0.1419	10.50	0.8482	9.60	0.00		0.00	0.0836	1.90
11	8.74	0.8066	9.90	0.2816	5.60	1.94	0.8718	1.60	0.5037	0.50
12	3.81	0.5565	5.80	0.5205	3.90	0.95	0.3833	2.90	0.2854	0.70
13	9.17	0.2808	5.00	0.9729	4.90	0.83	0.3176	0.00	0.0238	0.80
14	7.32	0.8557	6.60	0.5629	4.70	0.81	0.3176	0.00	0.0675	0.50
15	11.28	0.0326	3.80	0.4947	5.40	0.75	0.3172	0.00	0.0476	0.70
16	8.41	0.0298	1.60	0.1026	4.50	2.80	0.0810	0.00	0.0525	0.60
17	15.45	0.0045	3.40	0.7540	4.20	1.82	0.1552	0.00	0.3302	0.20
18	12.00	0.0038	1.50	0.4089	3.00	0.00		0.00	0.3003	0.40

TABLE 7
PREVALENCE (%) OF OVERWEIGHT (OW) AND OBESITY (OB) IN LITHUANIAN BOYS, 1985–2002

Age (years)	Overweight (%), BMI ≥25 and <30					Obesity (%), BMI ≥30				
	Vilnius, 1985	p 1985/2000	Vilnius, 2000	p 2000/2002	Other towns, 2002	Vilnius, 1985	p 1985/2000	Vilnius, 2000	p 2000/2002	Other towns, 2002
7	8.74	0.9155	9.25			0.00	0.1149	4.37		
8	6.60	0.4786	9.80			1.89	0.1549	0.00		
9	5.05	0.8606	5.70			3.03	0.7277	4.10		
10	6.61	0.4440	9.90	0.7370	8.50	0.94	0.3173	0.00	0.0420	2.50
11	10.17	0.4520	6.90	0.6015	8.80	0.85	0.6545	1.70	0.7363	1.10
12	11.21	0.3347	7.30	1.0000	7.30	1.87	0.9069	2.10	0.4833	1.00
13	6.48	0.6416	4.80	0.5310	6.70	0.00		0.00	0.0083	2.00
14	2.94	0.8190	3.60	0.4094	5.90	0.74	0.5821	1.80	0.5868	0.80
15	6.19	0.2189	2.60	0.2463	5.10	0.00	0.3184	1.30	0.4525	0.30
16	7.07	0.8939	7.64	0.6362	5.90	1.01	0.7559	1.60	0.5926	0.70
17	9.58	0.5547	6.90	0.7331	8.20	1.06	0.3172	0.00	0.0809	1.30
18	10.43	0.6118	8.00	0.6694	6.20	1.74	0.1555	0.00	0.0777	1.60

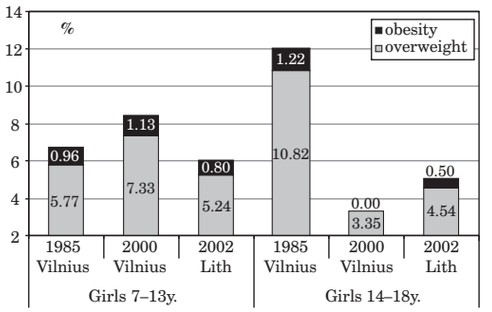

Fig. 5. The prevalence (%) of overweight and obesity in younger and older Lithuanian girls, 1985–2002.

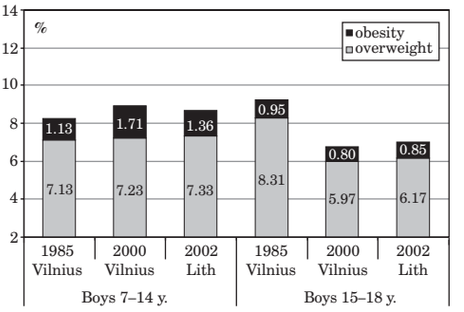

Fig. 6. The prevalence (%) of overweight and obesity in younger and older Lithuanian boys, 1985–2002.

weight individuals among younger Vilnius girls, but less overweight among the older Vilnius girls in comparison with the girls from the other fours towns of Lithuania (Figure 5). These differences were statistically insignificant ($p>0.05$). Hence, it could be assumed, that in prevalence of overweight and obesity Vilnius schoolchildren represented the other Lithuanian population quite well, i.e. the »Lithuanian average« was very similar to the »average of the capital«. Despite this fact, the prevalence of overweight and obesity among children from certain towns and settlements of Lithuania must be analysed separately, because the summing up of the data from different towns could obscure regional differences.

The analysis of the prevalence of overweight and obesity in the 2000–2002 according to the progress of adolescence showed the following age and sex related differences. On average, in the 2000–2002 study the prevalence of overweight was very similar among the younger Lithuanian boys (7.23–7.33%) and girls (5.24–7.33%), and the differences were insignificant ($p>0.05$) (Figure 5 and 6). At the end of adolescence the prevalence of overweight in girls from Vilnius and other towns (3.35–4.54%) was significantly ($p<0.01$) lower in comparison with the younger girls ($p<0.001$), and in comparison with the prevalence of overweight in older boys (5.97–6.17%), while there was no statistically significant difference ($p>0.05$) in prevalence of overweight between the younger and older boys from the 2000–2002 study (Figure 5 and 6). Hence, the diminishing prevalence of overweight at the second phase of adolescence was detected in Vilnius girls and girls from the other towns of Lithuania, but not in older Lithuanian boys from the 2000–2002 study.

The changes in prevalence of overweight and obesity in Lithuanian boys and girls during the 1985–2002

The analysis of the 1985 and the 2000–2002 data showed certain differences in the tendencies of overweight and obesity in younger and older children. Like in

the 2000–2002 study, there was no statistically significant gender difference ($p>0.05$) between the prevalence of overweight in girls (5.77%) and boys (7.13%) from the 1985 study at the beginning of maturation (Figure 5 and 6). The prevalence of overweight among older girls in comparison with younger girls increased ($p<0.01$) almost twice in the 1985 study (from 5.77% up to 10.82%), while only insignificant ($p>0.05$) age depended increase (from 7.13% up to 8.31%) in prevalence of overweight among boys was determined in the 1985 study.

After the comparison of the 1985 and the 2000–2002 studies, gender difference in prevalence of overweight and obesity were obtained only in older adolescents. There was no statistically significant difference ($p>0.05$) between the overweight among the younger boys from the 1985 study (7.13%) and the 2000 Vilnius study (7.23%), and no statistically significant difference ($p>0,05$) between the overweight among the younger girls from the 1985 (5.77%) and the girls from the 2000 Vilnius study (7.33%).

However, during the last 15 years the tendency in prevalence of overweight among older adolescent girls and boys was different: the rate of overweight and obesity in older Vilnius girls dropped from 10.82% up to 3.35%, and the difference was strongly significant ($p<0.0001$); meanwhile, among the older boys the slight (from 8.31% up to 5.97%), but insignificant ($p>0.05$) difference between the prevalence of overweight in the 1985 and the 2000 Vilnius study was detected (Table 6 and 7, Figure 5 and 6).

Because there were only minor differences between the prevalence of overweight and obesity in Vilnius schoolchildren and the adolescents from the other towns of Lithuania in 2000–2002 study, it could be assumed, that during the last 15 years Lithuanian girls, in generally, became evidently slimmer only at the end of adolescence, while older Lithuanian boys did not undergo very strong slenderize, though slight, but insignificant reduction of BMI and prevalence of overweight and obesity in older boys was also detected.

Discussion

The comparison of the 90th and the 97th percentiles of BMI of Lithuanian adolescents and the children from the other countries

The international cut-off points for overweight and obesity[6] served as a »datum-lines« for the comparison of the 90th and 97th BMI percentiles of Lithuanian adoles-

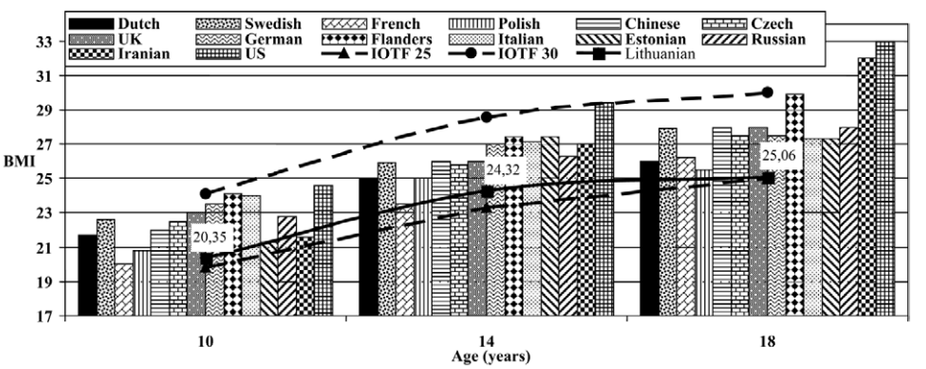

Fig. 7. The international Cut-off points for overweight (lower dashed line), obesity (upper dashed line), and the 97th percentile of BMI of Lithuanian girls (solid line) and girls from the other countries (different columns).

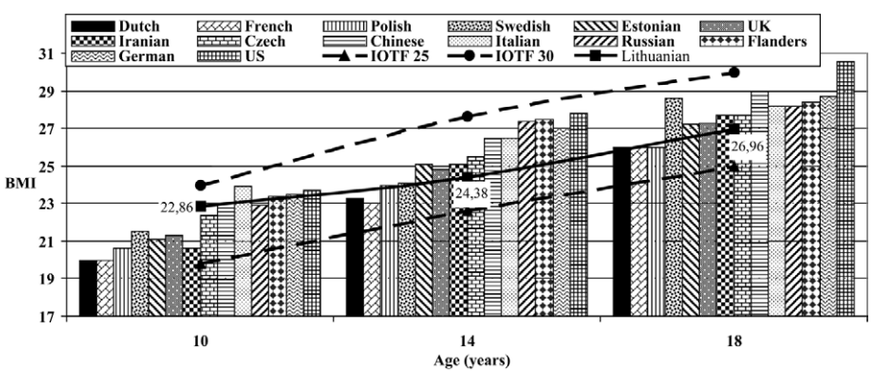

Fig. 8. The international Cut-off points for obesity (upper dashed line), overweight (lower dashed line), and the 97th percentile of BMI of Lithuanian boys (solid line) and boys from the other countries (different columns).

cents from 2002 study and the adolescents from the following countries: China[21], Czechia[22], Estonia[23], Flanders[24], France[25], Germany[26], Iran[27], Italy[28], The Netherlands[29], Poland[30], Russia[31], Sweden[32], UK[33], US[20]. The 90th and the 97th marginal BMI percentiles were chosen, because only few authors have published reference data on the 85th or the 95th BMI percentiles in children and adolescents.

In generally, the 97th BMI percentile of adolescent Lithuanian girls was situated very close to the international cut-offs for overweight (these cut-offs corresponded the BMI of 25.0 at the age of 18 y.). Obviously, it was distributed considerably lower than the line representing the international cut-offs for obesity (these cut-offs corresponded the BMI of 30.0 at the age of 18 y.), and reached only 25.06 at the age of 18 years (Fig. 7). All in all, the 97th BMI percentile for adolescent girls was reached at certain ages in only a few countries (for example, Flanders[24], Italian[28] data), and even exceeded it in the US[20] and Iran[27]. Hence, the 97th BMI percentile for Lithuanian girls had one of the lowest values.

Regarding the 97th BMI percentile of adolescent Lithuanian boys, it was approximately in the middle between the international cut-offs for overweight and obesity. It reached 26.96 at the age of the 18 years, and was similar to the 97th BMI percentile of boys from many other countries (Figure 8). Only at the age of 18 years the 97th BMI percentile of US[20] boys slightly exceeded the international cut-offs for obesity, while the 97th BMI percentile of boys from the other countries did not reach the international obesity cut-offs at all.

Hence, the 97th percentile of BMI in Lithuanian boys was similar to analogous BMI percentile of boys from many other countries and corresponded more or less middle values of the 97th BMI percentile worldwide. Therefore, the 97th or even the higher percentile of BMI of Lithuanian adolescents could be used for monitoring obesity. Moreover, comparative analysis of the same percentile of BMI of children from the other countries revealed, that with some exceptions, the 97th percentile was also lower than the international cut-off points for obesity.

The 90th BMI percentile of adolescent Lithuanian girls older than 10 years was distributed below the international cut-offs for overweight visibly, reached only the 22.98 value at the age of 18 years, and was considerably lower than the 90th BMI percentile of the girls from many other countries (Figure 9). Meanwhile, the 90th BMI per-

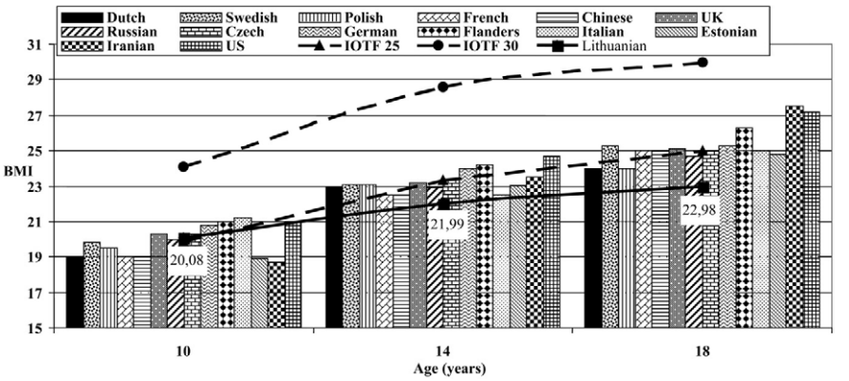

Fig. 9. The international Cut-off points for overweight (lower dashed line), obesity (upper dashed line) and the 90th percentile of BMI of Lithuanian girls (solid line) and girls from the other countries (different columns).

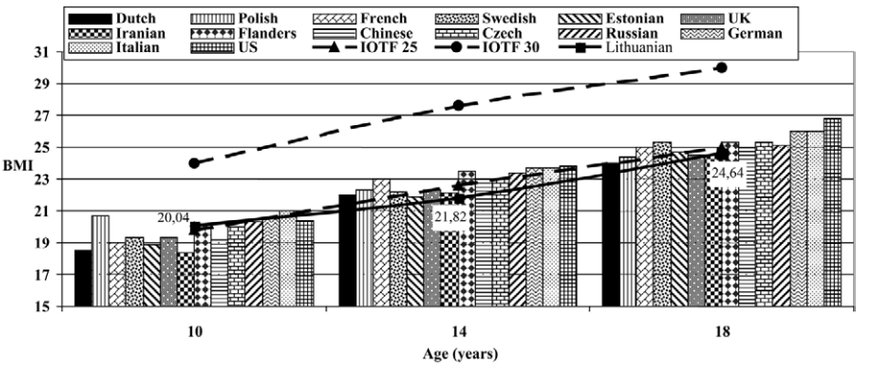

Fig. 10. The international Cut-off points for obesity (upper dashed line), overweight (lower dashed line), and the 90th percentile of BMI of Lithuanian boys (solid line) and boys from the other countries (different columns).

centile of girls from many other countries fluctuated around the line representing the international cut-offs for overweight, but at the age of 18 years the 90th BMI percentile of US[20] and Iranian[27] girls considerably exceeded the international cut-offs for overweight.

The 90th BMI percentile of adolescent Lithuanian boys more or less coincided with the international cut-offs for overweight, reached the value 24.64 at the age of 18 years, and was similar to the reference data of BMI in boys from many other countries (Figure 10). Likewise, the 90th BMI percentile of boys from many other countries fluctuated around the line representing the international cut-offs for overweight, and at the age of the 18 years only the 90th BMI percentile of US[20] boys exceeded the international cut-offs for overweight considerably.

Hence, it could be assumed, that the right marginal BMI percentiles of the adolescent Lithuanian boys were more similar to many other reference data worldwide, whereas adolescent Lithuanian girls were among the slimmest girls. Accordingly, the 90th percentile of BMI of Lithuanian boys and girls could be used to monitor overweight in Lithuanian children and adolescents, whereas the 90th percentiles of BMI of children from many other countries were higher than international cut-off points for overweight.

Summing up our results on BMI and comparing them with the data from the other countries, it could be assumed, that the means of BMI in Lithuanian children, in generally, were only slightly smaller, but the 90th and the 97th percentiles of BMI of Lithuanian children (especially in older girls) were significantly lower. The Lithuanian girls became more slender during the last decade in comparison with Lithuanian boys, whereas recently the majority of the investigators reported the increasing BMI in children and adolescents worldwide[44–46]. It is interesting, that Lithuanian data on BMI trend were in line with the data on the BMI of children and adolescents in our neighbour states – in Estonia[23] and Latvia[47].

The possible factors of such changes of physical status of Lithuanian children could be related with the changes in economical and social conditions after the 1990, but also with the changes in the life style, recent norms and fashions for optimal body size and shape, because body size of boys did not undergo such a strong change towards slimness. The possible reason of this phenomenon – the inadequate self-perception of body size in relation with social and mass media pressure in adolescent Lithuanian girls was discussed elsewhere[42–43]: the older adolescent girls had much higher incorrect body perception and dissatisfaction in comparison with the younger girls, for example, 22%–41% of the 10–13 year old girls and even 42%–53% of the 14–18 year old females overestimated their body weight in comparison to their actual body mass index. The same studies revealed the impact of mass media (magazines, TV, movies) and the opinion of peers (friends) on the body perception of adolescent Lithuanian girls (50%–60 % of the older adolescent girls indicated those factors as influencing their concept of the perfect body shape). There were insignificant differences between the body image and the factors influencing body size perception between the girls from Vilnius and from the other towns of Lithuania. Moreover, it turned out that the majority of girls with body dissatisfaction started to diet or to exercise because of fashion pictures, unrealistically thin models or some articles about »ideal« weight[42–43].

Finally, few outlines for future research could be drawn from this study: to examine the additional marginal percentiles (the 91, 98th, 99th and 99.6th) as a possible cut-offs for overweight and obesity in Lithuanian children and adolescents; to reveal the local cut-offs, that would correspond the growth and maturation process of Lithuanian children and adolescents, but should pass through the BMI value 25.0 and the BMI value 30.0 at the age of 18 years.

The comparison of the prevalence of overweight and obesity of Lithuanian girls and boys and children from the other countries

The increasing body mass index and dramatically rising rates in prevalence of overweight and obesity in children and adolescents from Europe, America, Asia and Australia were widely discussed in the literature of the last few years[44–46,48–66]. The data on weight status recently became more or less comparable, because many authors reported analyses of BMI in children according to the age and sex, presented the same marginal percentiles, and gave the prevalence (%) of overweight and obesity according to the International Obesity Task Force (IOTF) recommendations. For example, T.Lobstein and M.L.Frelut[44] summarized data on 21 surveys in Europe, and revealed a tendency for a higher prevalence of overweight among children in Western and especially Southern Europe: the prevalence of overweight in the 7–11 years old children on the average varied from 10% in Russia to 36% in Italy, and the prevalence of overweight in the 14–17 years old adolescents fluctuated between 9% in Russia and 23% in Cyprus. Hence, our findings showed comparatively low prevalence of overweight and obesity in Lithuanian children of all ages, especially among the older adolescents (overweight including obesity): 6.10–11.5%/8.60–13.62% in the 7–11 years old Lithuanian girls/boys respectively, and even lower prevalence 1.60–6.60%/3.90–9.50% in the 14–17 years old girls/boys.

Moreover, in the 2000–2002 study the prevalence of obesity in Lithuanian girls, especially in older adolescent girls, was lower than in older boys, while the majority of the investigators from the other countries (but not all) reported the higher prevalence of overweight and obesity in girls than in boys. Thereinafter, the data on the prevalence of overweight (including obesity) according to the IOTF cut-off points from the following countries were summarised:

– Lithuania (the present study): 4.60–11.50%/4.80–13.62% in the 7–13 years girls/boys, and 1.5–6.60%/3.90–9.50% in the 14–18 years old girls and boys;

- Finland[48]: 11.2/19.4% in the 12–18 years old girls/ boys (the same sexual differences were characteristic to our sample also, but the prevalence of obesity among Lithuanian children was lower);
- Greenland[49]: 21.7% total for boys and girls of 6–7 years old;
- England[50]: 23.6/17% in the 7–11 years old girls/boys;
- England[51]: 16.7/12.7% in the 9–11 year old girls/boys;
- Scotland[51]: 19.6/13.4% in the 9–11 year old girls/boys;
- Northern Ireland[52]: 26.3/19.5% in the 12 years old girls/boys, and 19.1/13.4% in the 15 years old girls/ boys;
- Poland[53]: 15.8/15.0% in the 7–9 years old girls/boys;
- East Germany[54]: 26.5/26.8% in the age of 8–10 years girls/boys, and 30.5/32.7% in the age of 11–14 year girls/boys;
- France[55]: 18.1/18.3% in the 7–9 years old girls/boys;
- Switzerland[56]: 19.1/16.6% in the 6–12 years old girls/ boys;
- Portugal[57]: 33.71/29.41% in the 7–9 years old girls/ boys;
- Italy[58]: 25.1/27.6% in the 3–17.5 years old girls/boys;
- Greece[59]: 30/33.1% in the 6–10 years old girls/boys;
- United Arab Emirates[60]: 27.2/24.8% in 4–18 years old girls/boys;
- -South Africa[61]: 3.0/1.7% (national), 3.9/2.0% (provincial), 5.6/2.2% (rural) in the 8–11 years old girls/ boys;
- Australia[62]: 21.1/19.5% in the 2–18 years old girls/ boys;
- Mexico[63]: 27.5/24.7% in the 10–18 years old girls/ boys;
- Chile[64]: 27.1/26.0% in the 6–7 years old girls/boys;
- Southern Brazil[65]: 18.0–22.9%/20.6–24.7% in the 7–10 years old girls/boys;
- Brazil[66]: 14.8/13.1% in the 10–18 years old girls/ boys;
- China[66]: 7.0/8.4% in the 10–18 years old girls/boys;
- Russia[66]: 8.3/9.6% in the 10–18 years old girls/boys;
- US[66]: 26.3/25.0% in the 10–18 years old girls/boys.

Obviously, in most countries the prevalence of overweight was higher in girls than in boys, and, on average, it was also higher among older children in comparison with the younger ones, while the opposite situation was detected among Lithuanian children and adolescents. Summing up the overlooked references, it could be concluded, that the prevalence of overweight among Lithuanian children and adolescents was comparatively low, approximately the same like among Russian and Chinese children. Nevertheless, more recent data showed the increasing prevalence of overweight and obesity among Chinese children also, but the latter results were obtained using different cut-off points[67], or were based on self-reported data[68]. On the other hand, the results of present study (based on the anthropometrical results) was in line with the study, conducted on self-reported data in 13 European countries, Israel and US, and our data confirmed very low prevalence of overweight in Lithuanian children also[45].

Moreover, most of the authors have reported dramatically increasing prevalence in overweight and obesity during the last 20–30 years worldwide, and the especially rapid increment was detected during the last 10 years in many countries[46,48–52,54,57–59,62, 64,66–68]. However, during the last decade in Lithuania the prevalence of overweight decreased. It is interesting, that the decreasing prevalence of overweight was obtained in Russian population also[66]. All in all, the level of overweight and obesity among Lithuanian schoolchildren in the 2000–2002 study was approximately the same as that found in Finland[48], Greenland[49], England[50–51] or Australia[62] 20–30 years ago.

The body size and physique depends on both genetic and environmental, socio-economic factors[5,8,12–13,69]. Moreover, the relationship between the relative body fat amount and the BMI is specific in children of different ethnic background[70]. Hence, the present study suggests the importance of the further investigation of possible factors, that could influence the changes in physical status of Lithuanian children, the examination of the growth trends in the other cities and villages separately, the research of changes in different components of body mass (the lean body mass and body fat trends).

Our study was conducted in the 2000–2002, and perhaps, represents the transitional period of economical and social changes, as well as shift in cultural values and individual behaviour in the society. After the political changes in Lithuania since the 1990 during the first 5–6 years of independency the living standards on average decreased, later stabilised, and only during the last 3–4 years started to increase demonstrably [39–41]. Lithuanian children and adolescents from the 2000–2002 study grew up during the period of economic and social changes in Lithuania. Certain worsening of the economic level after the 1990, as well as specific nutritional factors and the difference between the socio-economic situation in the capital and the other towns of Lithuania might have the influence on growth and the changes in physique of children, but of both genders.

Meanwhile, the present study showed that only the bodies of the older girls underwent the significant slenderising in comparison with boys, hence, these gender differences in body size changes, presumably, could be related rather with the changes in the life style, recent norms and fashions for optimal body size than with the other factors. Moreover, the 1997–1998 study of the health behaviour and nutritional status of adult Lithuanian population showed only the minor differences between the separate regions of Lithuania[71]. The similar study of the nutritional status of children and adolescents was not conducted up till now.

Recently the life style and nutritional habits in Lithuania are getting in step with the trends in many Western countries: the physical activity of children is decreasing, the sedentary behaviour increasing, the consumption of fast food, soda and sweetened drinks and monosodium glutamate is growing. All these factors could alter overweight and obesity rates of growing population[72–76]. The

detail analysis of the socio-economic situation, living standards and nutritional peculiarities of the growing population might help to promote the future tends in Lithuania, can activate policies and planning to bypass the disadvantages of modern life style and nutrition.

Acknowledgement

The presentation of this paper on the conference »Anthropological Perspectives on the Obesity Pandemic in Women: Causes, Costs, Controls« held in June, 2006 on Hvar, Croatia was supported by a grant from Wenner-Gren Foundation for Anthropological Research.

REFERENCES

1. WHO, Physical status: the use and interpretation of anthropometry, (WHO Technical Report Series, 1995). — 2. WHO, Obesity: Preventing and Managing the Global Epidemic, (Geneva, WHO, 2000). — 3. De ONIS M, Int J Obes Relat Metab Disord, 28 (2004) 81. — 4. LAHTI-KOSKI M, GILL T, Defining childhood obesity. In: KIESS W, MARCUS C, WABITSCH M (Eds.): Obesity in childhood and adolescence. (Pediatr Adolesc Med, Basel, Karger, 2004). — 5. CAMERON N, DEMERATH EW, Yearb Phys Anthropol, 45 (2002) 159. — 6. COLE TJ, BELLIZZI MC, FLEGAL KM, BMJ, 320 (2000) 1. — 7. CHINN S, RONA RJ, Ann Hum Biol, 29 (2002) 306. — 8. US PREVENTIVE SERVICES TASK FORCE, Pediatrics, 116 (2005) 205. — 9. FREEDMAN DS, WANG J, MAYNARD LM, THORNTON JC, MEI Z, PIERSON JR RN, DIETZ WH, HORLICK M, Int J Obes, 29 (2005) 1. — 10. DEMERATH EW, SCHUBERT CM, MAYNARD LM, SUN SS, CHUMLEA WC, PICKOFF A, CZERWINSKI SA, TOWNE B, SIERVOGEL RM, Pediatrics, 117 (2006) 487. — 11. FLEGAL KM, WEI R, OGDEN C, Am J Clin Nutr, 75 (2002) 761. — 12. FLODMARK C-E, LISSAU I, MORENO LA, PIETROBELLI A, WIDHALM K, Int J Obes, 28 (2004) 1189. — 13. MILLER J, ROSENBLOOM A, SILVERSTEIN J, J Clin Endocrinol Metab, 89 (2004) 4211. — 14. SINGHAL A, LUCAS A, Lancet, 363 (9421) (2004) 1642. — 15. OREN A, VOS LE, UITERWAAL CSPM, GORISSEN WHM, GROBBEE DE, BOTS ML, Int J Obes, 27 (2003) 1383. — 16. ENGELAND A, BJØRGE T, SØGAARD AJ, TVERDAL A, Am J Epidemiol, 157 (2003) 517. — 17. SINGHAL A, WELLS J, COLE TJ, FEWTRELL M, LUCAS A, Am J Clin Nutr, 77 (2003) 726. — 18. FREEDMAN DS, KHAN LK, SERDULA MK, DIETZ WH, SRINIVASAN SR, BERENSON GS, Pediatrics, 115 (2005) 22. — 19. ARYA R, DEMERATH E, JENKINSON CP, GÖRING HHH, PUPPALA S, FAROOK V, FOWLER S, SCHNEIDER J, GRANATO R, RESENDEZ RG, DYER TD, S. A. COLE, ALMASY L, COMUZZIE AG, SIERVOGEL RM, BRADSHAW B, De FRONZO RA, MacCLUER J, STERN MP, TOWNE B, BLANGERO J, DUGGIRALA R, Hum Mol Genet, 15 (10) (2006) 1569. — 20. KUCZMARSKI RJ, OGDEN CL, GRUMMER-STRAWN LM, FLEGAL KM, GUO SS, WEI R, CURTIN LR, ROCHE AF, JOHNSON CL, CDC Growth Charts: United States, Adv Data 2000, Available from: http://www.cdc.gov/growthcharts, accessed April 09, 2006. — 21. LEUNG SS, COLE TJ, TSE LY, LAU JTF, Ann Hum Biol, 25 (2) (1998) 169. — 22. BLÁHA P, VIGNEROVÁ J, RIEDLOVA J, KOBZOVA J, KREJČOVSKÝ L, BRABEC M, Nationwide anthropological survey of Czech children and adolescents 2001, Czech Republic (in Czech) (SZU, Praha, 2005). — 23. GRÜNBERG H, ADOJAAN B, THETLOFF M, Growth and growth disorders: Methodological instructions for evaluation children's physical development (in Estonian) (Tartu, 1998). — 24. ROELANTS M, HAUSPIE R, Flemish Growth Charts, 2–20 years: Use and interpretation, VUB 2004, Available from: http://www.vub.ac.be/groeicurven, accessed April 09, 2006. — 25. ROLLAND-CACHERA MF, COLE TJ, SEMPE M, TICHET J, ROSSIGNOL C, CHARRAUD A, Eur J Clin Nutr 45 (1991) 13. — 26. KROMEYER-HAUSCHILD K, WABITSCH M, KUNZE D, GELLER F, GEIß HC, HESSE V, Von HIPPEL A, JÄGER U, JOHNSEN D, KORTE W, MENNER K, MÜLLER G, MÜLLER JM, NIEMANN-PILATUS A, REMER T, SCHÄFER F, WITTCHEN HU, ZABRANSKY S, ZELLNER K, ZIEGLER A, HEBEBRAND J, Monatsschr Kinderheilkd, 149 (2001) 807. — 27. HOSSEINI M, CARPENTER RG, MOHAMMAD K, Ann Hum Biol, 26 (6) (1999) 527. — 28. LUCIANO A, BRESSAN F, ZOPPI G, Eur J Clin Nutr, 51 (1997) 6. — 29. COLE TJ, ROEDE MJ, Ann Hum Biol, 26 (1999) 303. — 30. KACZMAREK M, Poznan growth study: Physical growth of boys and girls (in Polish) (Institute of Anthropology, Poznan, 2001). — 31. GODINA E, Dynamics of human growth and development: Aspects within the space and time, (Habilitated Thesis), (In Russian), (Moscow State University, Moscow, 2001). — 32. HE Q, ALBERTSSON-WIKLAND K, KALBERG J, Acta Paediatr, 89 (2000) 582. — 33. COLE TJ, FREEMAN JV, PREECE MA, Arch Dis Child, 73 (1995) 25. — 34. MARTIN S, SALLER K, Lehrbuch der Anthropologie I (in German) (Stuttgart, Fischer Verlag, 1957). — 35. MADRIGAL L, Statistics for anthropology (Cambridge University Press, Cambridge, 1998). — 36. TUTKUVIENE J, Acta medica Lituanica, 12 (2005) 9. — 37. TUTKUVIENE J, Anthrop Anz, 63 (2005) 29. — 38. TUTKUVIENE J, Growth and physical status of the child. In: RAUGALE A (Eds), Children's diseases, Vol.1 (In Lithuanian) (Gamta, Vilnius, 2000). — 39. Statistical yearbook of Lithuania 1993 (Statistics Lithuania, 1994). — 40. Statistical yearbook of Lithuania 1999 (Statistics Lithuania, 1995). — 41. Statistical yearbook of Lithuania 2004 (Statistics Lithuania, 2005). — 42. TUTKUVIENE J, Acta medica Lituanica, suppl.8 (2001) 32. — 43. TUTKUVIENE J, Trends of body mass index, body size self-perception and factors of body dissatisfaction of adolescent Lithuanian girls. In: KURT WA, KEMKES-GROTTENTHALER A (Eds), Kinderwelten: Anthropologie – Geschichte – Kulturvergleich Šin GermanĆ (Böhlau Verlag, Köln, Weimer, Wien, 2002). — 44. LOBSTEIN T, FRELUT ML, Obes Rev, 4 (2003) 195. — 45. LISSAU I, OVERPECK MD, RUAN WJ, DUE P, HOLSTEIN BE, HEDIGER ML, Arch Pediatr Adolesc Med, 158 (2004) 27. — 46. JOLLIFFE D, Int J Obes, 28 (2004) 4. — 47. DUĬEVSKA I, Physical status and sexual maturation of 7–18 years old girls (in Latvian) (Institute of Anatomy and Anthropology, Riga Stradins University, Riga, 2003). — 48. KAUTIAINEN S, RIMPELA A, VIKAT A, VIRTANEN SM, Int J Obes Relat Metab Disord, 26 (2002) 544. — 49. SCHNOHR C, SØRENSEN TIA, NICLASEN BV, Int J Circumpolar Health, 64 (2005) 157. — 50. LOBSTEIN TJ, JAMES WPT, COLE TJ, Int J Obes, 27 (2003) 1136. — 51. CHINN S, RONA RJ, BMJ, 322 (2001) 24. — 52. WATKINS DC, MURRAY LJ, McCARRON P, BOREHAM CAG, CRAN GW, YOUNG IS, McGARTLAND C, ROBSON PJ, SAVAGE JM, Int J Obes, 29 (2005) 579. — 53. MALECKA-TENDERA E, KLIMEK K, MATUSIK P, OLSZANECKA-GLINIANOWICZ M, LEHINGUE Y, Obes Res, 13 (2005) 964. — 54. FRYE C, HEINRICH J, Int J Obes Relat Metab Disord, 27 (2003) 963. — 55. ROLLAND-CACHERA MF, CASTETBON K, ARNAULT N, BELLISLE F, ROMANO MC, LEHINGUE Y, FRELUT ML, HERCBERG S, Int J Obes, 26 (2002) 1610. — 56. ZIMMERMANN MB, GUBELI C, PUNTENER C, MOLINARI L, Swiss Med Wkly, 134 (2004) 523. — 57. PADEZ C, FERNANDES T, MOURÃO I, MOREIRA P, ROSADO V, Am J Hum Biol, 16 (2004) 670. — 58. CELI F, BINI V, De GIORGI G, MALINARI D, FARAONI F, Di STEFANO G, BACOSI ML, BERIOLI MG, CONTESSA G, FALORNI A, Eur J Clin Nutr, 57 (2003) 1045. — 59. KRASSAS GE, TZOTZAS T, TSAMETIS C, KONSTANTINIDIS T, J Pediatr Endocrinol Metab, 14 (2001) 1319. — 60. AL-HADDAD FH, LITTLE BB, ABDUL GHAFOOR AG, Ann Hum Biol, 32 (2005) 72. — 61. JINABHAI CC, TAYLOR M, SULLIVAN KR, Eur J Clin Nutr, 57 (2003) 358. — 62. MAGAREY AM, DANIELS LA, BOULTON TJC, MJA, 174 (2001) 561. — 63. Del RIO-NAVARRO BE, VELAZQUEZ-MONROY O, SANCHEZ-CASTILLO CP, LARA-ESQUEDA A, BERBER A, FANGHANEL G, VIOLANTE R, TAPIA-CONYER R, JAMES WPT, and ENSA 2000 Working group, Obes Res, 12 (2004) 215. — 64. KAIN J, UAUY R, VIO F, ALBALA C, Eur J Clin Nutr, 56 (2002) 200. — 65. De ASSIS MA, ROLLAND-CACHERA MF, GROSSEMAN S, De VASCONCELOS FA, LUNA ME, CALVO MC, BARROS MV, PIRES MM, BELLISLE F, Eur J Clin Nutr, 59 (2005) 1015. — 66. WANG Y, MONTEIRO C, POPKIN BM, Am J Clin Nutr, 75 (2002) 971. — 67. WU Y, BMJ, 333 (2006) 362. — 68. WONG JPS, HO SY, LAI MK, LEUNG GM, STEWART SM, LAM TH, Acta Paediatr, 94 (2005) 595. — 69. STAMATAKIS E, PRIMATESTA P, CHINN S, RONA R, FALASCHETI E, Arch Dis Child, 90 (2005) 999. — 70. DEURENBERG P, DEURENBERG-YAP M, FOO LF, SCHMIDT G, WANG J, Eur J Clin Nutr, 57 (2003) 405. — 71. KADZIAUSKIENE K, BARTKEVICIUTE R, OLECHNOVIC M, VISECKIENE V, ABARAVICIUS A, STUKAS R, ROBERTSON A, Health behaviour and nutritional status of Lithuanian population, 1997–1998 (in Lithuanian) (National Nutritional Centre of Ministry of Health, Vilnius University Medical Faculty, WHO Regional Office for Europe, Vilnius,

1999). — 72. LAHTI-KOSKI M, PIETINEN P, HELIÖVAARA M, VARTIAINEN E, Am J Clin Nutr, 75 (2002) 809. — 73. PRENTICE AM, JEBB SA, Obes Rev, 4 (2003) 187. — 74. ALMIRON-ROIG E, CHEN Y, DREWNOWSKI A, Obes Rev, 4 (2003) 201. — 75. VEUGELERS PJ, FITZGERALD AL, CMAJ, 173 (2005) 607. — 76. HERMANUSSEN M, GARCÍA AP, SUNDER M, VOIGT M, SALAZAR V, TRESGUERRES JAF, Eur J Clin Nutr, 60 (2006) 25.

J. Tutkuviene

Department of Anatomy, Histology and Anthropology, Faculty of Medicine, Vilnius University, Ciurlionio 21, LT-03101 Vilnius, Lithuania
e-mail: janina.tutkuviene@mf.vu.lt

INDEKS TJELESNE MASE, PREVALENCIJA PREKOMJERNE TEŽINE I DEBLJINE KOD LITVANSKE DJECE I ADOLESCENATA, 1985.–2002.

S A Ž E T A K

Ovo istraživanje prikazuje rezultate indeksa tjelesne mase (BMI), prevalencije prekomjerne tjelesne težine i debljine kod litvanske djece i adolescenata, od 1985. do 2002. Od 2000. do 2002. ispitivano je više od 9,000 školske djece u dobi od 7–18 godina u 5 najvećih gradova Litve i obližnjih naselja. Rezultati su uspoređeni s onima iz 1985. Prevalencija prekomjerne tjelesne težine i debljine bila je procijenjena korištenjem standarda International Obesity Task Force-a (IOTF). Prevalencija prekomjerne težine kod litvanske djece i adolescenata bila je veća kod mlađe školske djece u odnosu na starije adolescente. Prekomjerna težina je bila niža kod starijih djevojčica u odnosu na starije dječake: 4.60%–11.50%/ 4.80%–13.62% u skupini djevojčica i dječaka od 7 do 13 godina, naspram 1.5%–6.60%/3.90%–9.50% u skupini od 14 do 18 godišnjih djevojčica i dječaka. Prevalencija prekomjerne težine kod mlađih litvanskih adolescenata nije se značajno mijenjala u posljednjih 15 godina, ali je malo smanjena kod starijih dječaka i dokazivo smanjena kod starijih adolescentica. Općenito, prevalencija prekomjerne težine kod litvanskih adolescenata niska je u odnosu na djecu iz drugih zemalja.